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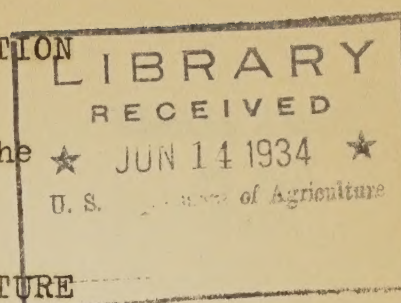




ANIMAL HUSBANDRY DIVISION  
HAWAII AGRICULTURAL EXPERIMENT STATION  
HONOLULU, HAWAII

Under the joint supervision of the

UNIVERSITY OF HAWAII  
and the  
UNITED STATES DEPARTMENT OF AGRICULTURE



Progress Notes on Experiments and Other Items of Interest

No. 6

May, 1934

These progress notes on experimental work and other items of interest to livestock men in the Territory are issued from time to time by the Animal Husbandry Division. You are invited to suggest other lines of research that you deem important and to submit inquiries to the University.

PINEAPPLE PLANTS AS FORAGE FOR CATTLE

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Object

Abandoned pineapple fields, or fields with a heavy growth of pineapple plants which is to be destroyed in order to plow and prepare the field for replanting, are sometimes found adjacent to pasture areas where because of prolonged drought the cattle may be in great need of forage. The question naturally arises as to the possible value of pineapple plants as a forage for cattle, either as a regular method of disposing of the old plants whenever a field is to be replanted and cattle pastures are adjacent, or as an emergency feed in periods of extreme drought when cattle in adjacent fields are literally starving.

Composition of Pineapple Plants

The following analyses of the total nutrients and the P<sub>2</sub>O<sub>5</sub> and CaO content are by the Experiment Station of the Pineapple Producers Cooperative Association.

<sup>1</sup> Special acknowledgement is due to Mr. Will Norman King, Agriculturist, and Dr. O. C. Magistad, Chemist, of the Experiment Station of the Pineapple Producers Cooperative Association, for their suggestions and continued interest and for supplying the pineapple plants and chemical analyses of same.







Nutrients in Pineapple Plants - Wet Basis

	<u>Stumps</u>	<u>Leaves</u>	<u>Entire Plant</u>
Water	65.00%	83.00%	79.50%
Carbohydrates, total	18.60	2.37	7.20
Sugars	.93	2.20	
Starch	16.10	.17	
Hemicellulose	1.57	---	
Crude protein	2.20	1.70	1.85
Fats	1.16	---	---

P<sub>2</sub>O<sub>5</sub> and CaO in Pineapple Plants

	<u>Percent P<sub>2</sub>O<sub>5</sub></u>			<u>Percent CaO</u>	
	<u>Dry basis</u>	<u>Wet basis*</u>		<u>Dry basis</u>	<u>Wet basis*</u>
Lab. No. 7626	0.25	0.050	"	1.52	0.30
Lab. No. 7843	0.27	0.054	"	1.05	0.21

Two analyses of the pineapple plants actually used in the feeding observation, to be detailed later in this report, are as follow:

Nutrients in Pineapple Plants - Dry Basis

Date obtained	8/24/33	9/26/33
	<u>Percent Dry Basis</u>	
Moisture	8.58	6.74
Crude protein	6.75	6.81
Ether extract	3.55	3.10
Crude fiber	22.39	21.09
Ash	5.67	5.81

Palatability of Pineapple Plants

Cattle may refuse to eat pineapple plants if ample other feed is available, but if this material is supplied in a cut or shredded condition, more or less mixed with other feeds, or if other feeds are withheld altogether, they will usually readily eat it after four or five days. However, even after being accustomed to it, our experience has not indicated that cattle will eat pineapple plants in preference to panicum and other commonly fed grasses if the latter are available.

\* 80 percent moisture assumed.



Nutrients in Pineapple Plants - Wet Basis

Native Plant	Leaves	Stems	Water
79.50	88.00	88.00	Carbohydrates, total
7.50	2.37	18.80	Sugars
	2.20	.98	Starch
	1.17	18.10	Hemicellulose
	---	1.87	Crude protein
1.88	1.70	2.20	Fats
---	---	1.18	

T<sub>2</sub>O<sub>2</sub> and CaO in Pineapple Plants

Lab. No. 7838	Lab. No. 7839	Percent T <sub>2</sub> O <sub>2</sub>	Percent CaO
0.27	0.28	0.080	0.30
0.084	0.080	1.52	1.88
0.27	0.28	1.05	0.81

The analyses of the pineapple plants actually used in the feeding observation, to be detailed later in this report, are as follows:

Nutrients in Pineapple Plants - Dry Basis

Date obtained	8/24/33	9/26/33
Moisture	8.88	8.74
Crude protein	8.75	8.81
Other extract	8.88	8.70
Crude fiber	22.39	21.09
Ash	8.87	8.01

Palatability of Pineapple Plants

Cattle may refuse to eat pineapple plants if ample other food is available, but if this material is supplied in a cut or shredded condition, more or less mixed with other foods, or if other foods are withheld altogether, they will usually readily eat it after four or five days. However, even after being accustomed to it, our experience has not indicated that cattle will eat pineapple plants in preference to pasture and other commonly fed grasses if the latter are available.



Observation Tests to Determine Value of Pineapple Plants  
When Fed to Cattle

Earlier tests having indicated that cattle would eat pineapple plants if no other roughages were available, a test was planned to determine its value in producing gains in Holstein heifers averaging 543 lbs. in weight and 11 months in age at the beginning of the test. These heifers were confined in a dry lot and fed all the cut pineapple plants (the plants were run through an ensilage cutter but since the feeding roll did not hold the plants very well, they were shredded rather more than cut and not in very small pieces) which they would consume, the portions not eaten being weighed back each day. In addition they were fed concentrates, the amounts and kinds being different during the different six week periods and hence are reported separately as three observation tests. The heifers were weighed once each week and the initial and final weight for each six week period was the average of three weights taken on three consecutive days.

Observation Test III<sup>1</sup> (6 weeks, Aug. 2 - Sept. 13, 1933)

In this test the regular heifer concentrate mixture was fed. This mixture contained the following feeds:

		<u>Dry Matter</u> lbs.	<u>Digestible</u>		<u>Nov. 1933 Cost</u>	<u>Per Ton</u>
			<u>Crude Protein</u> lbs.	<u>Total Nutrients</u> lbs.		
88 lbs.	rolled barley	79.8	7.92	69.87	\$1.386	\$31.50
10 "	soybean oil					
	cake meal	8.9	3.97	8.45	.17	34.00
1 "	salt	1.0	--	--	.008	15.00
1 "	raw rock					
	phosphate	1.0	--	--	.017	34.00
10 "	cane molasses	.7	.10	5.95	.002	5.00*
110 "	mixture	91.4	11.99	84.27	\$1.583	
100 "	"	83.1	10.90	76.61	1.44	

<sup>1</sup> Two earlier, short observation tests on palatability are not included in this condensed account.

\* For purposes of calculating feed cost, cane molasses is assumed to cost \$5.00 and pineapple plants \$2.00 per ton.



# Observation Tests to Determine Value of Wisconsin Plants

## When Fed to Cattle

Earlier tests having indicated that cattle would eat pinapple plants if no other roughage were available, a test was planned to determine its value in producing gains in Holstein heifers averaging 555 lbs. in weight and 11 months in age at the beginning of the test. These heifers were confined in a dry lot and fed all the cut pinapple plants (the plants were run through an ensilage cutter but since the feeding roll did not hold the plants very well, they were shredded rather more than cut and not in very small pieces) which they would consume, the portions not eaten being weighed back each day. In addition they were fed concentrated, the amounts and kinds being different during the different six week periods and hence are reported separately as three observation tests. The heifers were weighed once each week and the initial and final weight for each six week period was the average of three weights taken on three consecutive days.

## Observation Test III (6 weeks, Aug. 2 - Sept. 15, 1925)

In this test the regular water concentrate mixture was fed. This mixture contained the following feeds:

	Dry Matter lbs.	Crude Protein lbs.	Pinapple		Nov. 1925 Cost Per Ton
			Conc.	Total	
88 lbs. rolled barley	72.5	7.92	69.67		\$21.88
10 " soybean oil	8.9	2.27	6.45		24.00
1 " cake meal	1.9	--	--		18.00
1 " salt					
1 " new rock					
10 " phosphate	1.0	--	--		24.00
10 " cane molasses	.7	1.10	8.98		8.00
110 " mixture	91.4	11.99	84.27		\$1.88
100 "	83.1	10.90	76.61		1.44

The earlier, short observation tests on palatability are not included in this condensed account.

For purposes of calculating feed cost, cane molasses is assumed to cost \$2.00 and pinapple plants \$2.00 per ton.



During the six week period the average heifer consumed 22.2 lbs. of pineapple plants daily which with the 10 lbs. of concentrates fed daily supplied the following nutrients:

		<u>Digestible</u>			Nov. 1933	
		<u>Dry</u>	<u>Crude</u>	<u>Nutrients</u>	<u>Cost</u>	<u>Per Ton</u>
		<u>Matter</u>	<u>Protein</u>			
		lbs.	lbs.	lbs.		
10	lbs. heifer con-					
	centrates	8.3	1.1	7.7	\$.144	
22.2	" pineapple					
	plants <sup>1</sup>	4.6	.3	1.3	.022*	
		<u>12.9</u>	<u>1.4</u>	<u>9.0</u>	<u>.166</u>	

Required - 600 lb.  
growing heifer

(Morrison Standard) 13.8                      1.2                      9.2

It will be noted that the above combination supplied a slight excess of crude protein and nearly enough total nutrients to meet the Morrison standard.

The initial and final average weights of each heifer at the beginning and end of the six week period were as follows:

<u>Number</u>	<u>Final Weight</u>	<u>Initial Weight</u>	<u>Gain</u>	<u>Average daily gain</u>
129	630 lbs.	560 lbs.	70 lbs.	1.67 lbs.
130	617 "	560 "	57 "	1.30 "
131	<u>577</u> "	<u>510</u> "	<u>67</u> "	<u>1.60</u> "
Average	608 "	543 "	65 "	1.55 "

Under the conditions of Observation Test No. III the heifers made satisfactory normal gains and the feed cost was \$20.94 or 10.7 cents for each pound of gain made. In this test 64.7 percent of the dry matter consumed came from good quality concentrates and 35.3 percent came from the pineapple plants.

#### Observation Test No. IV (6 weeks, Sept. 27 - Nov. 8, 1933)

In this test the concentrates were changed and reduced so that each heifer received daily, in addition to all the pineapple plants consumed, only two pounds each of cane molasses and soybean oil cake meal. Five pounds of raw rock phosphate and two pounds of salt were added to each hundred pounds of soybean oil cake meal fed in order to insure ample minerals. The cane molasses was largely poured over the pineapple plants hoping thereby to increase consumption of the latter.

<sup>1</sup> The digestibility of the nutrients in pineapple plants has not been determined. In this and succeeding tests here reported they are assumed to be 2/3 digestible.

\* For purposes of calculating feed cost, cane molasses is assumed to cost \$5.00 and pineapple plants \$2.00 per ton.







There was a two week interval between tests III and IV, during which time the change in concentrate feed was gradually made. The heifers continued to receive only pineapple plants for roughage.

As will be shown this ration did not meet the Morrison standard but we were hoping to induce the maximum consumption of pineapple plants and reduce the cost of the ration. The soybean oil cake meal was used to bring up the protein content of the ration.

During this six week period each heifer consumed an average of 45.6 pounds of pineapple plants daily in addition to two pounds each of cane molasses and soybean oil cake meal. This did not meet the Morrison requirements as shown below:

	<u>Dry Matter</u> lbs.	<u>Digestible</u>		<u>Nov. 1933 Cost</u>
		<u>Crude Protein</u> lbs.	<u>Total Nutrients</u> lbs.	
<u>Requirements:</u> (according to Morrison Standard)				
600 lb. growing heifer	13.8	1.20	9.2	
<u>Supplied by:</u>				
45.6 lbs. pineapple plants	9.3	.56	2.7	\$.045
2.0 " cane molasses	1.5	.02	1.2	.005
2.0 " soybean oil cake meal	<u>1.8</u>	<u>.74</u>	<u>1.6</u>	<u>.034</u>
Total	12.6	1.32	5.5	\$.084

It will be noted that the above ration supplied enough protein, but only about 60 percent of the desired total nutrients.

The initial and final weights of each heifer at the beginning and end of the six week period were as follows:

<u>Number</u>	<u>Final Weight</u>	<u>Initial Weight</u>	<u>Gain</u>	<u>Average daily gain</u>
129	650 lbs.	653 lbs.	- 3 lbs.	none
130	623 "	627 "	- 4 "	"
131	<u>563</u> "	<u>587</u> "	<u>- 24</u> "	"
Average	612 "	622 "	- 10 "	

Under the conditions of Observation Test No. IV all of the heifers lost slightly, which is not surprising since the nutrients supplied as already shown did not meet the requirements of the Morrison Standard. This ration seemingly supplied barely enough nutrients to maintain the animals but nothing above that on which growth and fattening could take place. It might have value as an emergency ration to merely maintain animals during a period of feed shortage due to drought or other causes.

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In this case 25.5 percent of the dry matter consumed came from the soybean oil cake meal and cane molasses and the balance, 74.5 percent, came from the pineapple plants. The total feed cost in this test was \$10.61.

Observation Test No. V (6 weeks, Nov. 15 - Dec. 27, 1933)

Test No. IV having given unsatisfactory results as shown above, the concentrate ration was changed to the following mixture:

	Dry Matter	Digestible		Cost Nov. 1933
		Crude Protein	Total Nutrients	
	lbs.	lbs.	lbs.	
100 lbs. pineapple bran	82.2	2.4	52.0	\$ .900
40 " soybean oil cake meal	35.8	15.9	33.8	.680
5 " salt	5.0	--	--	.037
5 " raw rock phosphate	5.0	--	--	.085
150 " mixture	128.0	18.3	85.8	\$1.702
100 " "	85.3	12.2	57.2	1.135

Five pounds of this mixture, along with five pounds of cane molasses (largely poured over the pineapple plants) were fed daily to each heifer along with all the pineapple plants they would consume.

A week elapsed between tests IV and V, during which time the heifers were gradually changed to the new ration. During the six week period the heifers averaged 29.1 lbs. daily of the pineapple plants. In this case the maximum amounts of cheap, locally produced feeds were fed with the pineapple plant roughage, the concentrates consisting approximately of 50 percent cane molasses, 34 percent pineapple bran, 13 percent soybean oil cake meal and 3 percent minerals. With only 29 pounds of pineapple plants consumed daily, this, however, also failed to fully meet the Morrison standard.

	Dry Matter	Digestible		Cost Nov. 1933
		Crude Protein	Total Nutrients	
	lbs.	lbs.	lbs.	
<u>Requirements:</u>				
650 lb. growing heifer	14.6	1.17	9.1	
<u>Supplied by:</u>				
29.1 lbs. pineapple plant	6.0	.36	1.8	\$ .029
5.0 " concentrate mixture	4.3	.61	2.9	.057
5.0 " cane molasses	3.7	.05	3.0	.013
Total	14.0	1.02	7.7	\$ .099





The initial and final weights of each heifer at the beginning and end of the six week period were as follows:

<u>Number</u>	<u>Final Weight</u>	<u>Initial Weight</u>	<u>Gain</u>	<u>Average Daily gain</u>
129	670 lbs.	650 lbs.	20 lbs.	0.48 lbs.
130	650 "	630 "	20 "	0.48 "
131	590 "	577 "	13 "	0.31 "
Average	637 "	619 "	18 "	0.43 "

The results of this effort to feed large quantities of cane molasses along with only pineapple plants as the sole roughage can not be termed successful. While better results were secured than in test No. IV, they were far inferior to test No. III where ten pounds of a better concentrate mixture were fed. In this last test 57.2 percent of the dry matter came from concentrates, consisting mostly of cane molasses and pineapple bran, and 42.8 percent came from the pineapple plants. The total feed cost was \$12.39 or 23.4 cents for each pound of gain made.

The feces in this last test due to the large amount of cane molasses fed was dark and rather soft. One of the heifers, No. 129, seemed in fairly good condition at the end of the six weeks but the other two did not appear thrifty.

These heifers were put on the regular heifer concentrate mixture fed in Test No. III at the end of this test and were fed the regular roughages consisting largely of sudan, napier, and panicum grass, and in four weeks after being taken off the pineapple plant ration had made excellent gains as shown below.

<u>Number</u>	<u>Weight at end pineapple test on 12-27-33</u>	<u>Weights on regular feeds</u>		<u>Average daily gain in 4 weeks</u>
		<u>After 2 weeks on 1-10-34</u>	<u>After 4 weeks on 1-24-34</u>	
129	670 lbs.	720 lbs.	800 lbs.	4.6 lbs.
130	650 "	690 "	710 "	2.1 "
131	590 "	650 "	700 "	3.9 "
Average	637 "	687 "	737 "	3.5 "

These good gains made after the feeding of the experimental rations was discontinued indicates that the heifers had been fed an insufficient ration but seemingly they had not been injured, for when better feeds were supplied they immediately made good gains.



The initial and final weights of each heifer at the beginning and end of the six week period were as follows:

Number	Final Weight	Initial Weight	Gain	Average Daily Gain
129	670 lbs.	580 lbs.	90 lbs.	0.48 lbs.
130	680 "	630 "	50 "	0.48 "
131	690 "	577 "	113 "	0.81 "
Average	687 "	619 "	78 "	0.63 "

The results of this effort to feed large quantities of cane molasses along with only pineapple plants as the sole roughage can not be termed successful. While better results were secured than in test No. IV, they were far inferior to test No. III where ten pounds of a better concentrate mixture were fed. In this last test 67.5 percent of the dry matter came from concentrate, consisting mostly of cane molasses and pineapple bran, and 32.5 percent came from the pineapple plants. The total feed cost was \$12.39 or 23.4 cents for each pound of gain made.

The losses in this last test due to the large amount of cane molasses fed was dark and rather soft. One of the heifers, No. 131, seemed in fairly good condition at the end of the six weeks but the other two did not appear thrifty.

These heifers were put on the regular better concentrate mixture fed in Test No. III at the end of this test and were fed the regular roughage consisting largely of molasses, hay, and premium grass, and in four weeks after being taken off the pineapple plant ration had made excellent gains as shown below.

Number	Weight at end of pine- apple test on 12-27-33	Weight on 1-10-34	Weight on regular feeds After 2 weeks on 1-24-34	Average daily gain in 4 weeks
129	670 lbs.	780 lbs.	800 lbs.	4.6 lbs.
130	680 "	690 "	710 "	2.1 "
131	690 "	680 "	700 "	2.9 "
Average	687 "	687 "	737 "	3.5 "

There good gains made after the feeding of the experimental ration was discontinued indicates that the heifers had been fed an insufficient ration but seemingly they had not been injured, for when better feeds were supplied they immediately made good gains.



### Summary and Conclusions

1. In these tests three Holstein heifers, weighing about 600 pounds each, were fed shredded and cut pineapple plants as their sole roughage for a period of 147 days.

2. The average quantity of pineapple plants consumed daily by each heifer varied from 22 to 45 pounds depending on the kind and amount of concentrates fed. Decreasing the quantity of concentrates fed caused increased consumption of the pineapple plants but resulted in lower daily gains or even losses in the live weight of the heifers.

3. When the pineapple plants were supplemented with ten pounds of good quality concentrates daily for each animal, the heifers averaged 1.55 pounds daily gain over a six week period at a feed cost of 10.7 cents per pound gain.

4. When the concentrate supplement was reduced to two pounds each of soybean oil cake meal and cane molasses daily per heifer over a six week period, slight losses in the live weight of the heifers resulted.

5. When the concentrate mixture consisted of ten pounds daily of a mixture of cane molasses 50 percent, pineapple bran 34 percent, soybean oil cake meal 13 percent, and minerals 3 percent, an average daily gain of 0.43 resulted at a feed cost of 23.4 cents per pound of gain.

6. It appears from these observation tests that in order to get satisfactory gains in live weight, when using pineapple plants as the sole roughage, good quality concentrates must be fed at the same time.

7. The heifers were fed good concentrates and roughages at the termination of these pineapple plant tests and in the four week period immediately following pineapple plant feeding made an average daily gain of 3.5 pounds, indicating that the animals apparently had not been injured by five months of pineapple plant feeding.

8. While these tests do not indicate a high feeding value for pineapple plants, they do demonstrate that pineapple plants can be used to advantage as emergency feeds when pastures are dry from prolonged drought and no other forage crops are available.



## Summary and Conclusions

1. In these tests three Holstein heifers, weighing about 600 pounds each, were fed crushed and cut pineapple plants as their sole roughage for a period of 147 days.

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4. When the concentrate supplement was reduced to two pounds each of soybean oil cake meal and cane molasses daily per heifer over a six week period, slight losses in the live weight of the heifers resulted.

5. When the concentrate mixture consisted of ten pounds daily of a mixture of cane molasses 50 percent, pineapple bran 34 percent, soybean oil cake meal 15 percent, and minerals 1 percent, an average daily gain of 0.43 resulted at a feed cost of 25.4 cents per pound of gain.

6. It appears from these observation tests that in order to get satisfactory gains in live weight, when using pineapple plants as the sole roughage, good quality concentrates must be fed at the same time.

7. The heifers were fed good concentrates and roughages at the termination of these pineapple plant tests and in the four week period immediately following pineapple plant feeding made an average daily gain of 2.5 pounds, indicating that the animals apparently had not been injured by five months of pineapple plant feeding.

8. While these tests do not indicate a high feeding value for pineapple plants, they do demonstrate that pineapple plants can be used to advantage as emergency foods when pastures are dry from prolonged drought and no other forage crops are available.